ENERGY AUDIT STUDY

at

M.M. PROCESSING UNIT
(A unit of N.T.C.)

UNDER

INDIA-EC ENERGY BUS PROGRAMME

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M M PROCESSING UNIT

(A UNIT OF N.T.C.)

BANGALORE

ENERGY AUDIT REPORT

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ENERGY AUDIT REPORT

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P A R T - I

INTRODUCTION & EXECUTIVE SUMMARY

1.0 INTRODUCTION:

A comprehensive energy audit study was carried out by a team from TERI, to identify energy saving opportunities in the plant.

During the study, a detailed analysis was made of the major energy consuming plant items/processes, supplemented by measurements of various energy related parameters using appropriate instruments, in order to determine their energy efficiencies and evolve suitable means to minimise wastages.

The recommendations evolved were regularly discussed with senior plant personnel, to identify any practical problems that may arise in their implementation. Several suggestions were promptly implemented, immediately after discussions.

This report presents the findings, recommendations, and the financial implications of implementing these recommendations.

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2.0 ENERGY CONSERVATION WORK ALREADY DONE

The company is concious of the need to save energy. Following steps have already been taken to reduce the wastage and conserve energy.

i. The transformer is being switched off during Sundays and Holidays from 6.45 AM to 7 PM to minimise energy losses.

ii. Action has been taken to switch over to thyristor controls, where variable speed operation is required.

iii. House keeping measures for minimising the energy consumption have been implemented.

3.0 EXECUTIVE SUMMARY

The Part II & III of this report presents details of the analysis and recommendations identifying the opportunities for saving on electrical and fuel energy.

A brief summary of these is listed below:

PART II ELECTRICAL ENERGY

1. By operating the transformers under optimum loading conditions as Proposed in Section 4.0 it would be possible to save about 25,794 Kwhrs/Yr. The savings on this account works out to about Rs. 32,242 per year.

2. It is recommended to readjust the transformer tap positions as suggested in Section 4.2. This will improve output voltage and would result in saving energy losses to an extent of 4,289 Kwhrs/Yr ie., a saving of Rs.5,361 per year.

3. It is recommended that the conventional chokes be replaced by solid state chokes for all flourscent tube light fittings. It is estimated that there would be a saving of about 16,445 Kwhrs/Yr ie., Rs.20,556/Year.

4. The 40 W flourscent tubes are to be replaced by 36 watts slim tubes to minimise energy consumption. The savings in energy consumption would be of the order of 10,278 Kwhrs/Yr of Rs.12,848 /Year.

5. In all the above recommendations have potential for saving about 56,806 Kwhrs/Yr ie., Rs.71,007 Per year.

PART -III STEAM GENERATION,DISTRIBUTION & UTILISATION

THERMAL ENERGY

1.0 THERMIC HEATER

Close monitoring of excess air in the combustion chamber can result in fuel savings upto Rs 1 lakh per annum.

2.0 Distribution of steam at a higher pressure and reducing it to the required pressure locally will result in better control and quality of steam thereby reducing the steam demand.

3.0 Improving thermal insulation of all pipes, fittings, etc., can reduce the radiation losses, thus reducing fuel consumption by nearly 5%.

4.0 Condensate recovery system can result in 5 to 8% reduction in fuel consumption in the boilers (in the Minerva Mills).

5.0 Proper air venting, traps can reduce the steam demand by 5 to 10% on cylinder driers, heating chambers, etc.,

6.0 To install temperature regulators for jiggers bath and provide plastic balls on the bath surface will reduce the steam demand considerably.

7.0 To shift Polymerising unit nearer to Thermic heater and convert it to thermic fluid heating from electrical heating. This will reduce electricity consumption by nearly Rs. 53,000/ per month.

4.0 ACKNOWLEDGEMENT

We are extreamly grateful to the Management and Staff of M.M. Processing Unit for the kind co-operation given to us for carrying out the study and in providing all the relevent information. We are thankful to Mr Y M Shetty, Mills Manager, Mr Venkatanarasimhan, Mr V Vijayaraghavan and Mr Ramaswamy for sparing their time in taking us around the plant and explaining the process.

PART - II

ELECTRICITY UTILISATION

1.0 ELECTRICITY SUPPLY

The main source of supply is the K.E.B. supply. This supply is received at 4.6 KV and stepped down to 440V. The Contract Demand is 330 KVA. There is one transformer of capacity 750 KVA, 4.6 KV/ 440V. There is a proposal to change over from 4.6 KV to the standard 11 KV supply as per the requirements of K.E.B.

Alternate source of supply is a 310 KVA Diesel Generator set which is used only when the K.E.B supply fails.

2.0 ELECTRICITY CONSUMPTION

The unrestricted Maximum Demand is about 360 KVA. Average consumption is of the order of about 1 lakh units per month and the average Electricity Bill works out to about Rs. 1.30 Lakhs. the overall P.f. is maintained at 0.98 at the substation level.

2.1 MAJOR ELECTRICITY CONSUMPTION POINTS

The major electricity consumption points can be classified as :

- (i) Motors used for drives in various machines and compressors.
- (ii) Lighting loads.

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The motors used for drives vary from 2 H.P. to 50 H.P. Most of the machinery/motors are quite old. There is a proposal to replace the Group drives which are provided for Mercirizing /Printing machines. Thyrister control is already provided for some of the D.C.drives, with necessary change over systems.

The lighting load is of the order of about 9 KWS.

) MEASUREMENTS & CALCULATIONS

Various measurements were carried out for the study of loading pattern load factor etc., Sample test measurements were taken for motors of different capacities. Measured values have been analysed using necessary software and results are tabulated and shown in Annexure -I.

Summary of calculations has been placed in Annexure - II.

0 TRANSFORMER LOAD MANAGEMENT

On analysis of loading pattern on transformers, it is observed that the load factor works out to 45%. The Diversity Factor (based on transformer capacity) works out to 2.27. As against a Maximum Demand requirement of 330 KVA, the transformer capacity being 750 KVA, it is oversized. The utilisation of the transformer is poor. It is observed that the loading on the transformer is about 44%. The All day efficiency under existing loading conditions works out to 96.19%. There is scope for improving the All day efficiency of the transformer and to minimise the energy losses. It is observed that the load during the third shift

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TABLE - 1

TRANSFORMER LOAD MANAGEMENT

Sl. No.	Details	Unit	Existing Condiions	Proposed Conditions	Net Savings
1.	Iron Loss	Kwhrs/Yr	24,483	9,101	15,382
2.	Copper Loss	"	19,287	8,875	10,412
3.	Total Losses	"	43,770	17,976	25,794
4.	All Day Efficiency	%	96.19	98.4	-

is of the order of about 200 KVA (appx). The proposed transformer load management aims at achieving optimum load conditions to minimise the energy losses and improve the All day efficiency to 98.4%. The proposal is discussed in the following paragraph.

Table-1 indicates savings in Energy Losses.

4.10 PROPOSED SEQUENCE OF OPERATION

4.11 It is proposed to replace the existing 1 x 750 KVA transformer by 2 x 200 KVA transformers.

4.12 The loads operated during the thrid shift and lighting loads to be fed from transformer no.1 and the other loads from transformer no.2.

4.13 Transformer no.2 to be switched off during the 3rd shift operations, Sundays and holidays.

4.14 Transformer No.1 to be switched off during the day time on Sundays and holidays, as is being done for the existing transformer.

4.15 With this proposal it is estimated that there would be a saving of about 25,794 Kwhrs/Yr in energy losses in the transformer.

4.16 In view of the proposed conversion to 11 KV, the investment on the proposed 2 x 200 KVA transformers has to be considered along with the conversion proposals. However, the additional investment required would be marginal since the returns from the disposal of the existing copper wound transformer would almost offset the additional investment on the new transformers.

4.2 TRANSFORMER TAP POSITIONS

The input voltage measured at various points is around 369 Volts. It is advisable to increase the tap position to the next lower level so as to achieve an improvement of about 2.5% in the output voltage. It is estimated that there would be a saving of about 4289 Kwhrs/Year in energy losses.

5.0 ELECTRIC MOTORS

The analysis of performance of motors has been placed in Annexure - I.

5.10 It is observed that the motors are generally underloaded, during steady operating conditions. Since the starting torque requirement being high, replacement of motors by smaller capacity ones has not been considered.

5.20 It may be observed that some of the motors operate at very low P.F. The motors of capacity 15 H.P. and above and operating at P.F. of less than 0.50 may be considered for replacement by energy efficient motors.

5.3 POWER FACTOR

The average power factor at the substation level is maintained at 0.98. In some of the cases the capacitors are provided at the sub distribution boards already. It is advisable to provide capacitors to individual switch points for all the motors of capacity 15 H.P. and above.

6.0 LIGHTING SYSTEM

The total lighting load is 9 KW. There are 176 tube light fittings of 2 x 40 W.

6.10 REPLACEMENT OF CONVENTIONAL CHOKES BY SOLID STATE CHOKES

Usage of solid state chokes would reduce the energy losses in ballasts to a considerable extent.ie., by 25% to 30%. It is advisable to replace the conventional chokes by solid state chokes in stages. It is estimated that there would be a savings of about 16,445 Kwhrs/Year in energy consumption.

6.20 REPLACEMENT OF 40 W TUBES BY 35 W SLIM TUBES

It is advisable to replace all the 40W tubes by 35W slim tubes which consume lesser energy for the same lumen output. It is estimated that there would be a saving of about 10,278 Kwhrs/Year in energy consumption.

7.0 RECOMMENDATIONS

7.10 It is recommended that the transformer load management proposals as discussed in section 5.0 be implemented.

7.20 It is recommended to change the tap positions of the transformer to next lower stage so as to achieve 2.5% improvement in output voltages.

7.30 It is recommended to replace the motors of capacity 15 H.P. and above and operating at a P.F. of 0.5 by energy efficient motors.

7.40 It is recommended to provide capacitors at the load points especially for motors of higher capacities.

7.50 It is estimated to replace conventional chokes by solid state chokes in all flourscent tube light fittings.

7.60 It is recommended to replace 40 W tubes by 35 Watts slim tubes.

8.0 GENERAL OBSERVATIONS

8.10 Circuit breakers, disconnects and change over systems at the main substation have been maintained well.

8.20 Most of the house keeping measures for minimising the energy consumption have been implemented.

8.30 The existing transformer is being switched off during Sundays and Holidays from 6.45 AM to 7 PM to minimise energy losses.

8.40 Action has been taken to switch over to thyristor controls where variable speed operation is required. However, some of the proposals are yet to be implemented.

9.0 SUMMARY OF RECOMMENDATIONS AND POTENTIAL SAVINGS

Sl. No.	Proposal	Fuel Type	Estimated Annual Savings Kwhrs/Yr	Rs/Yr	Cost of Implementation Rs.	Simple Pay-back period
1.	Transformer Load Management	Electy.	25,794	32,242	-	-
2.	Changing of tap position in transformer	"	4,289	5,361	-	-
3.	Replacement of conventional chokes by Solid state chokes	"	16,445	20,556		
4.	Replacement of 40W tubes by 35W slim tubes	"	10,278	12,848		
		TOTAL	56,806	71,007		

ANNEXURE I

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ANALYSIS OF PERFORMANCE OF MOTORS

SLNO	--MOTOR REF-	--H.P.--	-HZ-	VOLTS-	AMPS	P.F.	-KVA-	-KWM	UNDER LOAD%	UNDER VOLT%	REMARKS
1	MERCIRIZER	45.00	48.40	374.11	91.60	0.20	58.80	12.27	63.44	12	LOW P.F.
2	PRINTING	35.00	48.20	375.84	19.40	0.26	12.57	3.33	87.24	12	LOW P.F.
3	JIGGER	3.00	48.30	368.91	2.30	0.59	1.83	1.08	51.56	14	LOW P.F.
4	BOILER PUMP	40.00	48.40	370.64	60.10	0.50	36.30	18.27	38.77	13	LOW P.F.
5	BOILER BLOWR	15.00	48.40	368.91	11.60	0.54	7.50	4.08	63.53	14	LOW P.F.
6	CALLENDER	50.00	48.30	367.18	44.20	0.68	28.89	19.80	46.91	14	LOW P.F.

ANNEXURE II

SUMMARY OF CALCULATIONS

1.0 SYSTEM PARAMETERS

$$L.F. = \frac{92,112}{300 \times 0.92 \times 24 \times 31}$$

$$= 0.448$$

$$L.L.F = 0.3\ (0.45) + 0.7\ (0.45)^2$$

$$= 0.135 + 0.142$$

$$= 0.277$$

2.0 TRANSFORMER LOAD MANAGEMENT

2.1 LOSSES UNDER EXISTING CONDITIONS

Iron Loss = [3.082 x {8760 - (56 + 12) 12}]

= 24,483 Kwhrs/Yr

Copper Loss = $8.8 \times 0.277 \times 0.998^2 \times 7994$

= 19,287 Kwhrs/Yr

Total Losses = 43,770 Kwhrs/Yr

All Day Efficiency = 96.19%

2.2 LOSSES UNDER PROPOSED CONDITIONS

Iron Losses = 1.23 x 4752 + 0.41 x 7944

= 9101 Kwhrs/Yr

Copper Losses = 3.9 x 4752 x 0.277 + 1.7
x 7944 x 0.277

= 8875 Kwhrs/Yr

Total Losses = 17,976 Kwhrs/Yr

All Day Efficiency = 98.4%

2.3 NET SAVINGS = 25,794 Kwhrs/yr

3.0 CHANGING OF TAP POSITIONS

Improvement in voltage = 2.5%

3.1 Savings in Cable/line losses = 0.0014 x 92,112 x 12
= 1547 Kwhrs/Yr

3.2 Savings in Energy Losses in Motors =

113 x 0.277 x 8760 x 0.05 = 13,710 Kwhrs/Yr

4.0 LIGHTING SYSTEM

4.1 Replacement of conventional chokes by solid state chokes

Savings in Energy Losses = 2 x 176 x 8 x 16 x 365
= 16,445 Kwhrs/yr

4.2 Replacement of 40 W tubes by 35 W slim tubes

Savings in Energy Consumption = 1.76 x 16 x 365
= 10,278 kwhrs/yr

P A R T - III

STEAM GENERATION, DISTRIBUTION & UTILISATION

1.0 THERMIC FLUID HEATER

1.1 OBSERVATIONS

There is one oil fired thermic fluid heater of Wanson Make, Thermopac model 150 U, heat output of 1,50,000 K.Cal/Hour. The Furnace Oil consumption is reported to be 1200 to 1300 litres/day for 3 shifts. The annual cost of fuel oil is around Rs.17.5 lakhs.

The Furnace oil is stored in an outdoor horizontal cylinder tank of 20,000 litres capacity. There is one more overhead day service tank of about 1000 litres just above the boiler house. This F.O. in this tank is heated by means of a steam coil to allow easy flow of F.O. However, there is no temperature controller to control the F.O. temperature. We recommend you to install a steam regulating temperature controller to avoid excessive heating of F.O. and wasting of steam.

There is one more indoor tank just above the ground level of approximate 2200 litres. This tank is heated by an electric heater and is also insulated to prevent heat loss.

TABLE - 1

FLUE GAS ANALYSIS OF THERMIC HEATER

Trial	% O_2	Flue gas Temp. ^{o}C	Combustion Efficiency	Excess air %	% CO_2
I	13.8	186	79%	140	5%
II	10.7	176	84%	87	8.1%

Flue gas analysis on the Thermic Heater was carried and it was found that oxygen content in the flue gas was 13.8%. In order to reduce the percentage of excess air, blower intake damper was closed a little and a second reading taken. This resulted in Oxygen content reducing to 10.7% and excess air to 87% from 140%.

The readings and analysis are given in the Table - 1.

1.2 RECOMMENDATIONS

It is evident from the results that by controlling the excess air entering into the combustion chamber, it is possible to reduce heat loss. It is therefore suggested that regular monitoring is done by measuring O_2 and CO_2 percent in the exhaust gas by a portable fyrite kit, and the amount of excess air controlled to get the optimum efficiencies at all times. Such a close control of excess air can result in considerable savings in the fuel consumption.

The savings are calculated as under :-

Annual Savings =

$$\frac{\text{Improved Combustion Efficiency} - \text{Previous Combustion Efficiency}}{\text{Improved Efficiency}} \times \text{Annual Fuel Cost}$$

$$= \frac{84 - 79}{84} \times 17.5$$

= Rs. 1,04,166 or approximately Rs.1 Lakh /Annum

2.0 STEAM DISTRIBUTION

2.1 OBSERVATIONS

Steam is obtained from their sister concern Minerva Mills, situated next door by means of two steam pipe lines. One of 50 NB size carrying high pressure steam at 4 to 5 Kg/sq.cm, and a 150 NB pipe arrying steam at 1 Kg/sq.cm.

The steam lines are very old and rusted and need replacement since they seem to have outlined their useful life. Detailed study of pipe sizing could not be carried out due to non-availability of layout drawing.

Insulation of pipes and fittings is also not proper.

2.2 RECOMMENDATIONS

a. It is advisable to generate steam at a higher pressure (Boiler's rated pressure) and trasmit it and reduce the pressure to the desired level at the consuming points. THe advantages are :-

   i. Steam undergoes drying effect due to reduction in pressure. (The difference in total enthapy between H.P. and L.P. steam converts the water particles into steam).

   ii. There will be accurate control of pressure at the steam using plant and the plant is not affected by pressure drop over the distribution system.

   As such obtaining steam at a higher pressure (ie., 10 Kg/sq cm) and then reducing it to the desired pressure by individual reducing valves should be considered.

b. To install individual line moisture separators before the entry of steam into machines. This will further reduce the moisture entering the machines. Any moisture content in steam will reduce the heat content of steam which leads to higher steam consumptions, longer heating time and heavier load in traps.

c. All steam and condensate lines including the pipe fittings etc., should be insulated. All uninsulated and bare hot surfaces radiate a lot of heat. Insulation is made at some places with mineral wool lined with asbestos content and covered with gunny cloth. This is prone to get water logged whenever the lines are outside the building. It is advisable to have mineral wool with a layer of water proofing chemical with the outer layer covered with aluminium cladding. This will be water proof and since aluminium has a bright surface the same has poor emissivity. This will further reduce the heat emission. All pipe fittings like flanges, valves also should be insulated to prevent heat loss. Each pair of flange is equal to 0.6 metre of bare pipe and each valve of 1.5 metre. The cumulative loss of all such fittings in a plant of your size will be enormous . Nowadays ready made flange and valve boxes of thermal insulation are available which are easy to fix and remove in case of maintenance. This should be actively considered.

3.0 STEAM UTILISING MACHINES

OBSERVATIONS

Steam is utilised by various machines for processing of cloth. The individual machines are listed below alongwith observations and recommendations.

3.1 19 CYLINDER DRYING RANGE

This is a very old machine and has 19 cylinders for drying cloth. The machine is likely to be scrapped but the same is still being operated.

Steam is used at 1.5 Kg/sq.cm. There are 2 float operated traps, each one cater to sets of 9 and 10 cylinders. There is no provision for air removal from the cylinders. The sides of cylinders and steam lines are not insulated. Steam inlet headers are rightly provided with air vents and the bottoms are drained with separate TD traps.

3.2 20 CYLINDER DRYING RANGE (HARISH MAKE)

This is a much newer machine and is provided with 4 air vents on steam headers. It has four Inverted Bucket type steam traps to drain set of five cylinders each. Steam is directly used at the line pressure, with no moisture remover at the inlet of the machine. There are no air vents on the cylinders.

3.3 16 CYLINDER DRYING RANGE (DYEING DEPT)

This is used for drying cloth after it is dyed. This is provided with a pressure reducing valve kept at the ground level. However, this is not effective in view of line pressure being only 1 Kg/sq.cm.

The machine is provided with four automatic air vents in the steam header and three inverted bucket traps,to drain these 20 cylinders. All steam valves and condensate pipes are bare without insulation. There are no air vents for removal of air from cylinders.

RECOMMENDATIONS

STEAM UTILISING MACHINES

(Cylinder drying ranges - 19 cylinders, 16 cylinders 20 cylinders)

a. To install float operated traps on each cylinder. Group trappings of cylinders leads to water logging in them since the loadings on each cylinders are different from others the rate of condensation will also be different.

b. To install individual automatic air vents for each cylinders and at the top of each steam header.

Air gets accumulated in the cylinders because Air can enter the steam space whenever the steam supply is stopped eg . after the 2nd shift. As the steam inside the cylinder starts cooling and condensing, vacuum is formed, and air from outside enters steam space from various joints etc., which are not absolutely leak proof. Air can also enter these cylinders alongwith steam since there will be some mixing of air with steam which enter boiler in the form of dissolved gases in feed water. This air will not be expelled from cylinders when steam is let in next day morning because the traps cannot handle air unless they are fitted with separate air vents.

Air is being a poor conductor of heat will form a layer of insulation inside the cylinder. This will result in cold spots on the cylinders apart from reduction in overall temperature of cylinders. At 5 Kg/sq.cm steam pressure the saturation temperatures is 158^{o}C. However, even 20% mixing of air in the steam will result he temperature to drop to 149^{o} C. And 50% contamination will result in temperature of 132^{o} C.

c. Side walls of all cylinders were observed to be bare and uninsulated. These chould be adequately insulated with glass wool to cut down heat losses. There is considerable scope to reduce these losses in all the cylinder drying ranges since each cylinder of approximately 3 feet diameter will radiate considerable heat.

d. All steam lines, headers and condensate piping from the machines should be insulated properly.

3.4 J - BOX MACHINE (RODNEY HUNT MAKE)

This is used for continuous scouring and bleaching of grey cloth. It has 3 stage operations viz., Scouring , Boiling and Washing. Steam is used only in the first two stages by direct injection to keep the cloth moist. Steam pressure is at around 1 Kg/sq.cm.

3.5 JT - 10 BEAM SCOURING AND BLEACHING

This is batch scouring and bleaching machine. Steam is used to keep the bath solution heated by means of open coil injection.

3.6 JIGGERS

OBSERVATIONS

There are 15 jiggers and one Jumbo size jigger, which are used for dyeing the cloth. Steam is used at the line pressure of 1 Kg/sq.cm. Out of the 15 jiggers only 5 nos. have indirect heating coils, whereas balance 10 nos. and the Jumbo jigger have direct injection of steam. There are no steam traps on the indirect heated oils. Further there is no provision for automatic

temperature control of bath but the same is done by manually operating the inlet valve. temperatures are maintained about 60 ^{o} C to 80 ^{o} C depending upon the production requirement, type of cloth to be dyed, dye, etc.,

RECOMMENDATIONS

As far as possible indirect heating should be used for Jiggers bath heating since it is good from the energy conservation point of view. There is scope to recover the heat from the hot condensate which is not contaminated if indirect heating is done. The jiggers bath surface may also be covered with plastic balls (Polypropelyene). This will prevent the heat loss by evaporation from the surface by nearly 70 percent.

3.7 FLOAT DYING MACHINE

OBSERVATIONS

This is a combined machine to carryout dying of cloth and drying it in the same run. The cloth is dyed in a bath and excess dye is removed by a mangle. The cloth is passed through three heated chambers where the temperatures are maintained at around 120 ^{o} C.

Steam is allowed into the chambers' heat exchange coils at the line pressure (4 Kg/sq.cm), there is no automatic tempeature controller nor any moisture separator at the inlet of steam pipe. The chambers have individual float traps (6 Nos) on heat exchangers and an additional Inverted Bucket trap is provided common on the condensate header. Insulation of steam and condensate pipes is not adequate and some portion of pipes are wound with asbestos ropes.

RECOMMENDATIONS

a. To provide automatic temperature controllers to control the chamber temperatures and prevent steam wastage when no cloth is passing through.

b. All hot surfaces should be properly insulated to prevent heat loss.

c. To consider recirculation of exhaust air from the chamber by suitably modifying the exhaust ducts. This can save considerable energy as the air once heated is still capable of absorbing more moisture. A by pass in the ducting can add some percentage of outside fresh air.

3.8 H.T. / H.P. BEAM DYEING MACHINE

OBSERVATIONS

This is used mainly for dying polyester based fabrics which require higher temperatures for dying them for cotton fabrics. This is a batch production machine, where the cloth, is wound on a beam, is loaded in the machine. The cloth remains stationery but the dye is circulated at high pressure and high temperature (130 ^{o}C). Steam is used at 4 to 5 Kg/sq.cm from the H.P. steam line.

The liquor is passed through a heat exchanger which has steam coils for heating. After the dying cycle the dye is once again cooled by circulating it through the same heat exchanger, with cool water instead of steam.

The hot water is presently sent back to a common sump where it looses its heat.

3.9 JET DYING MACHINE

OBSERVATIONS

This is similar to the H.T./H.P. machine but the cycle time of batch production is reduced by circulating the cloth alongwith the dye.

RECOMMENDATIONS

These above two machines have good scope for recovery of heat since the hot water is returned to a common tank where it looses heat.

It is suggested that this hot water be locally stored in an insulated tank, kept closeby. This hot water can be used for preparation of dyes in jiggers. Presently, in jiggers the dye is prepared and steam is used to heat it. This can save considerable steam.

3.10 ZERO ZERO MACHINE (DHALL MAKE)

OBSERVATIONS

This is used for pre-shinking the cloth. It shrink the cloth before despatch and gives ironing finish. Steam is used mainly in moisturising chamber by direct spray, and in drying cylinders for ironing purposes. Steam is used at 1.0 Kg/Sq.cm pressure. Steam traps are provided properly. However, steam lines condensate pipes and cylinder sides are not insulated.

RECOMMENDATIONS

a. To insulate all the uninsulated surfaces

b. To recover the condensate which is being wasted presently.

3.11 POLYMERISING UNIT

OBSERVATIONS

This is used for setting of prints on synthetic fabrics. The temperature required is around 150°C. This has chambers heated with electrical heaters, whose total load is 120 KW. There are 3 chambers which are heated with steam at about 2.5 Kg/cm2. The steam chambers are rightly drained with individual traps. However, the pipes are not insulated.

RECOMMENDATIONS

a. This machine requires high temperature of 150°C for which electrical heaters are being used. It would be economical to use thermic heated coils for the purpose. However, the location of this machine is far from the Thermic Heater and we recommend that these machines be shifted to a nearby location. The Thermic fluid heater has sufficient capacity to heat this machine also.

b. To consider using water based dyes instead of kerosene based dyes. This will reduce energy requirement in Polymericsing process.

3.12 MERCERISING MACHINE

OBSERVATIONS

This machine is used to impart shine and increase the dye absorbing capacity. This machine is very old. Little steam is used here, mainly for heating the caustic soda bath,and washing stage. Steam is directly injected in the baths.

4.0 THERMIC FLUID HEATED MACHINE (ARTOS-MANEKLAL MAKE)

4.1 STENTER

OBSERVATIONS

This is used for stretching and to give chemical treatment before drying other operations. This machine has 4 chambers which are thermic fluid heated. However initial drying of cloth is done by steam heated cylinders (4 nos.). Steam is used at 1 Kg/sq.cm. The cylinders have a common trap for removal of condensate. Steam condensate lines and cylinder sides are not insulated. The cylinder also have no air vents. The machine drying chamber temperature is maintained at 175^{o}C. The insulation of chambers of machines is good.

RECOMMENDATIONS

a. To consider recirculation of hot exhaust gases. This will conserve considerable energy.

b. To provide automatic air vents on cylinders and individual traps for each cylinder.

c. To properly insulate all hot surfaces.

4.2 STENTER (5 CHAMBERS)

OBSERVATIONS

This machine is similar to the above machine except that there is no steam heating. The entire process is done by thermic fluid heating. The chambers are insulated properly.

5.0 THERMIC FLUID DISTRIBUTION SYSTEMS

OBSERVATIONS

The pipes are insulated with mineral / glass wool and covered with gunny bags. The surface temperatures on the insulation was measured and found to be 58°C .& 65 °C. At several places, especially on pipe fittings etc., there is no insulation. The uninsulated surface temperatures were found to be 140°C to 144°C. Only some lengths of pipes have aluminium cladding above the pipe insulation outside surface.

RECOMMENDATIONS

1. It is recommended that all the pipes and fittings on the thermic fluid lines be insulated with mineral wool and covered with Aluminium claddings. This will reduce the heat loss considerably.

6.0 STANDARD PRACTICES

Certain standard practices which if followed would ensure efficient operations and prevent loss of energy as listed below :-

A. STEAM DISTRIBUTION & UTLISATION CHECK LIST

Storekeeping steam

Is the steam used by each department metered?

Is a regular check made on the amount of steam used by each department ? .

Steam distribution

Are steam mains properly sized ? Properly laid out ?Properly drained ? Properly air vented?

Is adequate provision made for expansion ?

Can separators be used to improve steam quality?

Are there leaking joints and glands? Leaking valves and safety valves ?

Are all steam pipes, flanges and valves lagged ?

Can redundant steam piping be blanked off or removed ?

Process methods

Is the mechanical removal of moisture prior to drying by heat efficiently done ?

Is the material pre-heated using waste heat before processing if this is practicable ?

Can bare process plant surfaces be lagged ?

Are draughts allowed to chill hot rooms or heated surfaces?

Is process plant loaded as much as possible and idle time when hot cut to a minimum?

In hot air dryers, is air recirculated to the maximum extent and excess cold air in filteration avoided ?

Are process temperatures controlled ?

Are process steam pressure higher than they need be ?

When liquids are heated by direct steam injection is steam pressure as low as posible ?

Is the steam supplied to process plant as dry as possible? Are peak loads inevitable and, if so, is the boiler house given adequate warning ? can peak processes be staggered ?

Condensate and air removal

Is the correct type of steam trap used for each application ? Is it correctly installed and regularly maintained ?

Is each trap protected by a strainer and followed by a sight glass?

Are check valves fitted after the traps when necessary, if the condensate is lifted directly to an overhead return ?

Are by - passes fitted around steam traps only when essential and are they corectly used ?

Are traps which can be damaged by freezing, lagged when fitted in exposed positions ?

Is each steam space properly air vented for maximum output and even heating ?

Where condensate is lifted directly from steam traps, can output be improved by gravity drainage to a receiver from which a pump can lift the condensate ?

Flash steam, condensate and waste heat recovery

Is flash steam allowed to blow to waste?

Can its heat be used in low-pressure plant, for pre-heating cold material, for heating water or returned to the boiler feed tank ?

Is any condensate needlessly wasted ?

Are condensate return systems and feed tanks lagged ?

Is heat recovered from boiler blow down?

Can heat be recovered by heat exchangers from hot liquors or contaminated condensate ?

7.0 SUMMARY OF RECOMMENDATIONS

7.1 THERMIC HEATER

By controlling the amount of excess air nearly Rs 1 lakh/annum can be saved on the furnace oil consumption bill.

To provide automatic temperature regulator for maintaining fuel oil in overhead tank.

7.2 STEAM DISTRIBUTION

By obtaining steam at a higher pressure for all machines and reducing the pressure locally the quality of steam can be improved resulting in reduction in steam demand.

7.3 THERMAL INSULATION

All hot surfaces like steam pipes, flanges, valves, condensate lines, etc., should be properly insulated. This will result in condensate savings. Approximately 5 to 10% heat loss can be saved by this measure.

7.4 CONDENSATE RECOVERY

To install properly designed condensate recovery system from all machines and return the hot condensate through an insulated pipe to Boiler House. There will be atleast 5 to 8% reduction in fuel consumed at the boiler house.

7.5 STEAM UTILISING MACHINES

a. Proper traps, air vents should be installed on all the machines. This measure can save atleast 5% to 10% steam per machine.

b. All uninsulated surfaces on the machines, especially side walls of drying cylinders, etc., should be insulated to conserve heat.

c. Jiggers bath surfaces should be covered with plastic balls to prevent too much steam flashing out. To provide automatic temperature controllers for maintaining the bath temperature.

d. To shift Polymerising unit to a place nearer to thermic heater and change over to thermic heating instead of electric heating. This will sreduce electrical consumption by nearly 38000 units/ month costing almost Rs.53,000/per month.